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ABSTRACT

This monograph provides an historical overview of handwriting assessment, followed by suggestions for informally assessing student handwriting errors and implementing improvement strategies. The monograph specifically addresses: (1) research on handwriting; (2) a rationale for remediation of handwriting errors; (3) techniques for evaluating handwriting, including qualitative and quantitative approaches; (4) purposes of instructional assessment; (5) error analysis techniques, including methods for integrating error correction into daily instruction. A case study is presented of a fifth-grade student with illegible handwriting. The student and teacher together identified illegible or nearly illegible words, determined what made the words difficult to read, identified overall problems, prioritized the problems, established contingencies for handwriting improvement, and monitored progress. A sample handwriting marking guide and handwriting improvement contract are provided. (Contains 35 references.) (JDD)

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MULTIDISCIPLINARY DIAGNOSTIC AND TRAINING PROGRAM

UNIVERSITY OF FLORIDA

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Monograph #22

March, 1989

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MULTIDISCIPLINARY DIAGNOSTIC AND TRAINING PROGRAM (MDTP)

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PREFACE

Many students' handwriting ranges from difficult to read to virtually unintelligble. Once students are beyond third grade little is done to remediate handwriting difficulties. The present monograph provides an historical overview of handwriting assessment followed by detailed suggestions for informally assessing student handwriting errors. Strategies classroom teachers can implement to improve the handwriting of students are presented.

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Diagnosis and Remediation of Handwriting Errors

Introduction

Poor letter formation skills are evident in the handwriting of many students. This should not be surprising because the teaching of handwriting has not received much attention for some time. University teacher preparation programs seldom include training in handwriting instruction within their curricula. In fact, student teachers report that handwriting ranks lowest among those subjects they feel prepared to teach (Addy & Wylie, 1973). Consequently, handwriting is inconsistently taught at best, and in some elementary schools, not taught at all.

With the exception of orthopedic conditions, or severe intellectual or visual handicaps, the majority of exceptional as well as regular education students have the ability to produce legible handwriting. The prerequisite perceptual, motor, and intellectual skills are in the repertoires of most students identified as eligible for special education services. Nonetheless, few of these students exhibit good handwriting. There appear to be several reasons for the discrepancy between student ability and actual handwriting performance. The best examples of good handwriting may be found in classes where teachers expect, value and reinforce legible handwriting, and where they directly teach handwriting skills. Unfortunately, as Milone and Wasylyk (1981) suggest, few special or general educators have been trained to teach handwriting and as a result, handwriting is the "neglected R".

The major purpose for legible handwriting is to record and to communicate information. This includes writing for one's own personal use (e.g., class notes, shopping lists), written communication to others (e.g., letters, memos), writing related to seeking employment and job-related skills (e.g.,

job applications) and writing to obtain information from others. Although recent technological advances, including computers in the home and in the workplace, have helped circumvent some of the problems associated with poor writing, the dawn of the information age does not preclude the need to proficiently form letters and words for the purpose of communicating (Naisbett, 1982). Finally, students who do not learn to form letters well--either in isolation or within the context of written language, have a reduced ability to compete in the classroom.

We begin this monograph with a review of selected aspects of the handwriting literature as it relates to the error analysis approaches we advocate. A brief overview of handwriting assessment is provided to establish the place of error analysis as an assessment tool. A procedure for analyzing handwriting errors in initial or remedial instruction is demonstrated. Finally, we conclude with an illustration of how error analysis can be integrated with systematic contingency arrangements to improve the learner's everyday handwriting.

Review of Research on Handwriting

How much instructional attention does handwriting receive? Addy and Wylie (1973) reported the results of an international survey on handwriting. They distributed 400 questionnaires to urban and rural teachers, kindergarten through third grade. The summary resulted in the following conclusions:

1) Handwriting instruction is fairly uniform throughout the United States and Canada.

2) Manuscript writing is initiated in the first grade and cursive writing in the third grade. Formal classes in handwriting are given in kindergarten by 34 percent of the rural teachers and 15 percent of the urban teachers.

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3) Handwriting is regarded as having a "close" or "very close" relationship with "other language arts," with authors speculating that a decline in handwriting skill has occurred as a result of intergrated instruction (Enstrom, 1965; Hofmeister, 1981).

4) The entire class is taught at one time in most schools, and the length of lessons ranges from eleven to twenty minutes per day.

5) First grade teachers spend the most time on handwriting.

6) Three guideline paper and pencils are preferred by most teachers.

7) Only 30 percent of all teachers use workbooks for instruction. Copying models, a common instructional practice, is accomplished through the use of chalkboards, overhead projectors, workbooks, and work sheets.

8) Left handed children usually are given some special instruction in handwriting.

9) Grades are given for handwriting in 70% of the schools surveyed.

10) Evaluation of handwriting almost always is made by casual teacher observation (rather than through the use of criterion models and evaluation scales).

These results, coupled with the findings of other studies, suggest that handwriting instruction is not only minimally taught but is a low instructional priority. Nonetheless, students often are referred to special education because of poor handwriting legibility. Questions arise concerning youngsters who struggle with this communication skill. How should we teach them? How can we motivate them? The following sections of this monograph review handwriting error analysis. Finally, we will discuss the analysis and remediation of student handwriting errors as an interrelated process.

Review of Handwriting Assessment

Over the years, handwriting educators have had varied opinions regarding what should be emphasized and how it should be taught. For instance, Ruedy (1983) suggested that handwriting assessment and instruction must look at both letter formation skills and the attitude of the student toward improved letter production. When a student's writing is slow and laborious or the result is consistently of poor quality and ill received by others, writing becomes a punishing chore. Inevitably the students' willingness and ability to perform are affected. Clearly, for students of all ages there are benefits to having good handwriting skills. Even at the secondary grade level students may gain from remedial handwriting instruction. Ruedy, (1983), for example, noted several positive outcomes of successful remedial instruction for high school students.

1. Poor spelling may be improved since the student who is comfortable with cursive writing will be able to produce a word as a naturally flowing unit rather than as a series of unconnected printed letters.
2. A distaste for compositions, essays, and reports may disappear or diminish when it is no longer a painful process for students to commit their thoughts to paper.
3. Content may improve when the mechanics of handwriting are no longer a stumbling block.
4. Self-confidence and pride in the quality of work may increase when the student is able to produce work that "looks good".
5. Students who write fluently and frequently experience the tactile-kinesthetic stimulation needed to increase the likelihood of learning and remembering.

6. Finally, the teacher's job will be more pleasant and less time consuming if student papers are legible and neat.

In all, the benefits of directly and thoroughly teaching handwriting skills appear worth the assessment, planning and instructional time required. How to approach the task of teaching the learner who has not mastered handwriting skills remains to be addressed. The following section provides an historical perspective on clinical and experimental approaches for teaching handwriting.

Handwriting in Perspective

In the early years of special education the best or most appropriate mode of initial handwriting instruction was widely debated. This controversy resulted in programs that emphasized a variety of approaches. For example, the development of associative processes, such as eye-hand coordination, figure-ground discrimination and proprioceptive feedback were touted as critical initial steps in handwriting instruction (Pomeroy, 1971; Stewart, 1973). As a result, young children spent many hours tracing letters in the sand, feeling the contours and texture of cut-out letters and numerals, and connecting the dots. Regardless of the questionable merit of these activities they can still be found in both initial and remedial handwriting instruction. Probably the most predominant form of initial handwriting instruction, as reflected in instructional materials and teaching practices, is to trace along dotted lines and over prepared samples of letters and numerals. Judging from years of research (cf. Askov & Greff, 1975; Stewart, 1973), the value of tracing as an initial instruction activity is grossly overrated, particularly to the extent that it is prolonged for weeks, months and even years beyond any demonstrated utility. Tracing appears to be more akin to artistic drawing than to the production of units of communication.

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Since the 1940s, copying from a model consistently has been demonstrated to be superior to tracing or associative process building when teaching the basic units and letters of handwriting. Hirsh and Niedermeyer (1978) examined the effects of copying versus faded tracing on letter formation; their results indicate that copying is the most effective procedure to promote correct letter formation. Similar outcomes were reported by Askov and Greff (1975) and Stewart (1973). In light of these findings, it is unfortunate that copying from a model has been given a lesser role in handwriting programs than tracing. When teachers do use models, they often use them inappropriately. For example, the teacher may provide good models but minimal feedback when teaching students to form letters (Hofmeister, 1973; 1981). Nonetheless, modeling is a documented strategy for teaching handwriting. When integrated with systematic instruction, copying from a model produces a rapid remediation of handwriting deficits (Stowitschek, 1978; Stowitschek & Stowitschek, 1979). In addition, it appears that students who show improved handwriting when models are used demonstrate improved production of letters and numerals once the model is removed (Stowitschek, 1978).

Techniques for Evaluations Handwriting

As in the teaching of handwriting, the evaluation of students' handwriting typically has been inconsistent and nonsystematic. Addy and Wylie (1973) found that 70% of schools surveyed base handwriting evaluation on casual teacher observation or personal judgement. By comparison, standardized or systematic procedures are seldom used. Therefore, it should not be a mystery that handwriting problems arise frequently. Most teachers simply do not know how to adequately evaluate student performance and to relate the outcome of that evaluation to appropriate corrective strategies. Fortunately, both norm- and criterion-referenced alternatives are available to assist in

making instructional decisions regarding the form and function of handwriting. We should point out that the appropriateness of a particular assessment approach is related directly to its purpose; more on this subject is offered later in the monograph.

Normative assessment. Two of the first normative handwriting scales were developed by Thorndike (1910) and Ayres (1912). These original scales set the pattern for many subsequent handwriting scales. The scales consisted of a series of graded handwriting samples and guidelines for comparing the samples to the student's handwriting products. Unfortunately, teacher judgments of handwriting samples are highly variable. The reliability of procedures using graded samples has been poor and their utility questionable (Buros, 1965; Watts, 1971). Responding to these issues, Freeman (1955) used a set of letter formation criteria initially in his handwriting scales; however, later versions focused on measuring general excellence. Since Thorndike's, Ayre's, and Freeman's scales are used to compare a student's handwriting performance to those of others, and not to a standard of letter formation, they have dubious utility in conducting quality assessment.

Criterion-referenced assessment. In recent years, attempts have been made to design objective, reliable procedures for measuring student's manuscript letter formation. Some efforts have focused on establishing measurable criteria for determining quality and/or rate of performance (Hopkins, Schutte & Gorton, 1971; Lewis & Lewis, 1965; Watts, 1971). In other studies, pre and posttest samples (Hofmeister, 1969), transparent overlays (Helwig, Johns, Norman, & Cooper, 1976; Jones, Trap, & Cooper, 1977; Trap, Milner-Davis, Joseph, & Cooper, 1978), and template underlays (Stowitschek & Stowitschek, 1975; 1979) have been used to assist in the assessment process. In the later cases, measurable criteria and pre and posttest comparisons were

used in combination. The criterion-referenced assessment process appears to be more practical for diagnostic and remediation purposes than for the comprehensive assessment of handwriting achievement.

Form and function. Although handwriting itself yields a concrete permanent product, it has proven to be exceedingly difficult to measure objectively. Handwriting assessment procedures are based on both form and function. Form assessment pertains to general factors affecting letter formation itself. The form of letters may be affected by the three "Ps" of general handwriting assessment. The three "Ps" include: posture, position, and pencil. "Posture" pertains to correct alignment of the body and positioning in the chair in relation to the desk or writing surface. The student should be seated upright with the lower back against the seat back. The writing surface should be at such a height so as to avoid leaning or slumping over the paper. Students who rest their head on a hand or the desk see a distorted image. The writing arm should rest on the writing surface with the upper back and shoulders leaning forward slightly. The arm should be pivotable to accomodate writing.

"Position" concerns placement of the writing paper so that the letter characters are not on a severe slant, for left-handed writers the top of the page is angled toward the right so that the writing hand does not obstruct the writer's view. Right-handed students should place the paper angled slightly to the left. Paper alignment should remain the same for all writing; therefore; it is important to check the paper position often to maintain correct alignment.

"Pencil" refers to the manner in which the writer holds the pencil. Some students have poor muscle control which may affect their ability to hold a pencil. Check the students' positions and their ability to hold the pencil

correctly. Occasionally, a special pencil or holder will be needed. The writing instrument should not be grasped too closely or too far away from the point. Depending upon the size of the writer's hand and the position of greatest comfort, the writing instrument should be held approximately 1-1/2 inches above the point. The pencil should be positioned between the first two fingers and the thumb. Interested readers are referred to the DLM Handwriting Resource Book (Hofmeister, 1981) for further discussion of these considerations.

Assessment of movement. Another important factor in letter formation is continuity of movement. Assessment of movement in manuscript letter formation often focuses on the ability to place a pencil point at a prescribed starting point, produce circles in both clockwise and counterclockwise directions, and produce straight lines from top-to-bottom and left-to-right. For cursive handwriting and intermediary approaches, such as the D'Neilian Handwriting Program (Thurber & Jordan, 1981), an additional movement consideration is the uninterrupted flow of interconnected letters within a word through the use of leading and trailing lines. Continuity of movement is a major factor affecting the rate or quantitative aspect of handwriting. (Handwriting rate is discussed in greater detail in the next section.)

Qualitative Aspects of Handwriting Assessment

Probably the most critical aspect of form assessment is evaluating the accuracy with which characters are formed. That is, the qualitative dimensions of handwriting or letter formation itself must be evaluated carefully. Historically, letter formation consistently has been identified as a key variable in legibility (Buros, 1965; Quant, 1946). Criteria used in inspecting handwriting samples are centered on specifying the attributes of shape, spacing, size, connectedness, slant, and position.

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The function of handwriting pertains to the extent to which the written product communicates. Typically, legibility is the main deterrent to communication and becomes an issue when handwriting skills are needed to complete assignments. Students may be able to produce correctly formed letters in isolation, but in the process of writing rapidly to finish an assignment legibility often suffers. As noted, assessment of handwriting legibility typically has been based on subjective judgment. For example, Starlin (1982) divides legibility into four categories for judging accuracy: letter formation, letter size, slant and spacing. Letter formation includes connecting strokes correctly, closing letters such as o and a, dotting letters such as i, crossing t and x, and forming the descending portion of letters such as f and g correctly. Letter size is grouped into maximum, intermediate and minimum size letters. A sixty degree slant is recommended. Starlin also suggests that the criteria for spacing between letters to be enough space for the oval of a 9; between words to be enough space for a lower case o; and between sentences to be enough space for two lower case oo's. These subjective criteria are similar to those recommended by numerous other authors and may be useful for assessing and teaching students with few difficulties.

On the other hand, some attempts to provide objective indices of legibility have been made. Quant (1946) used optometric devices to measure the frequency and cumulative duration of eye hesitations of readers of handwriting samples. Although this method is objective, it has not been put into applied use. No comparably objective measure has been found. In the case of extreme illegibility, the ability of one or more readers to recognize written words may be the assessment index of choice.

Quantitative Aspects of Handwriting Assessment

In addition to the qualitative aspects of letter formation and its affect on legibility, the rate or quantitative nature of a student's handwriting influences school achievement. Students whose rates of handwriting are very slow are unable to communicate to their teachers the knowledge they have on a particular subject. The simple cycle of not finishing assignments, getting poor grades, and appearing less than competent may set the stage for progressive failure. To assist the student who painstakingly executes each letter, the teacher needs to set rate objectives and increase the student's performance to an acceptable level of proficiency (Gable, Hendrickson, Tenenbaum, & Morsink, 1986). Starlin (1982) suggests various proficiency rates for letters in words, letters in sentences and paragraphs, and words in prose writing. These per minute rates are recommended:

a. 100-200 correct letters in words.

b. 100-200 correct letters in sentences and paragraphs.

c. 20-40 correct words in prose with the prose composition itself being 99% correctly written.

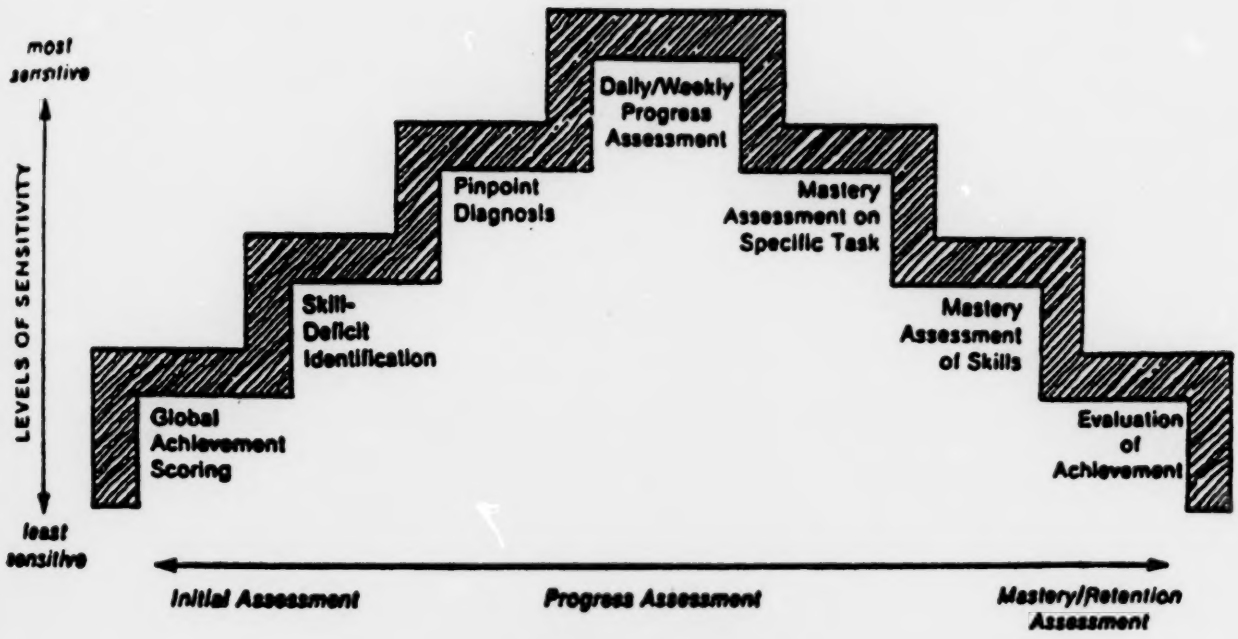
Starlin (1982) also suggests rates for prealphabetic an isolated alphabet writing. Right curves ( )), left curves (( ), under curves (⌣), over curves (⌢), and ovals (ooo) are taught to a rate of 100-200 characters per minute. Single connected letters (e.g., *ab*) and double connected letters (e.g., *oo*) also have a recommended criteria of 100-200 units per minute. In summary, teachers must consider both the qualitative and quantitative dimensions of handwriting when assessing or remediating handwriting deficiences. Subsequent sections of this monograph address issues related to assessing and remediating students with more severe and persistent handwriting difficulties.

Instructional Assessment -- Its Various Purposes

The purposes of assessment vary according to the stages of the instructional process. Decisions regarding each student become progressively more discrete as the teacher determines the focus of instruction and progressively more comprehensive as the teacher seeks to determine the impact of instruction. Stowitschek, Gable, and Hendrickson (1980) describe four levels of assessment relative to instructional decision-making: 1) initial selection, 2) specific skill assessment, 3) baseline performance and on-going monitoring, and 4) mastery assessment. Figure 1 shows the typical progression of a good assessment-intervention-evaluation plan.

Typically, the initial step is to determine the kind and degree of a student's instructional needs in handwriting. A global assessment procedure (such as a normative handwriting scale) is appropriate for identifying students in need of instruction. Criterion-referenced assessments such as the Brigance Diagnostic Inventory of Basic Skills® (Brigance, 1977) may be useful for this first step. Students identified as potential candidates for handwriting instruction next produce writing samples to pinpoint specific deficits. This more in-depth assessment of specific handwriting skills is done by more extensive sampling of student performance. At this stage, either an informal or criterion-referenced test may be used to pinpoint deficits and establish baseline levels of performance prior to beginning instruction. Curriculum-based or precision teaching probes (i.e., one minute samples of targeted handwriting skills) may be taken to determine student rate of performance. Once instruction is initiated, daily/weekly assessments are conducted to ascertain the rate of growth. Finally, the last types of assessment relate to mastery, application, retention, and generalization.

FIGURE 1


most sensitive
LEVELS OF SENSITIVITY
least sensitive
Global Achievement Scoring
Skill-Deficit Identification
Pinpoint Diagnosis
Daily/Weekly Progress Assessment
Mastery Assessment on Specific Task
Mastery Assessment of Skills
Evaluation of Achievement
Initial Assessment
Progress Assessment
Mastery/Retention Assessment
PURPOSES OF ASSESSMENT

Handwriting programs such as the one described by Stowitschek and Stowitschek (1979) include procedures for pinpointing skills, monitoring student handwriting daily, and inspecting and evaluating mastery of handwriting skills. It is during this assessment-intervention process that error analysis has its greatest applicability.

As handwriting instruction progresses, the focus of assessment involves: (a) the development or remediation of individual letter formation skills, (b) pinpointing of problems as they occur, and (c) determination of whether or not mastery of targeted skills constitutes a substantive improvement in overall handwriting. Throughout the assessment-intervention cycle, the criterion-referenced measures used initially can be used again to guide further instructional decision making. In the assessment plan we have just described, the analysis of handwriting errors becomes an integral part of the teaching of handwriting because it is embedded within the framework of an instructional program. The sections which follow describe two approaches to error analysis which have been used as part of the instructional program.

Analyzing Errors in Handwriting

Analysis of handwriting errors during initial or remedial instruction of letter and numeral production can be approached using the principles of "discrimination learning". Students struggling to improve their handwriting should be given ready access to appropriate models and taught to judge the adequacy of their writing in relation to these models or "objective standards". Faulty handwriting instruction, on the other hand, typically includes the use of massed practice (e.g., 1 1/2 hrs. on Tuesday), nondifferential teacher feedback (e.g., "That looks pretty good, Jill"), and inappropriate models which can hinder acquisition of handwriting (Hofmeister, 1973). Furthermore, in the absence of a standard criteria, the student's own

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writing efforts end up serving as models. Yet we know that letter production attempts interspersed with feedback can yield improved writing. Ferster, Culbertson, and Perrot-Boren (1975) liken the process of using models correctly to a series of alternating match-to-sample, match-to-oddity discriminations. They describe this process:

> If...a child who is copying the O is not under the control of variations in size of letters, he has no basis for adjusting his writing to produce a letter of the same size he is copying. To the extent that the child is already controlled by the correspondence between the O he has drawn and the sample there will be immediate differential reinforcement of the performance. (p. 577)

During initial instruction, it is important that error analysis center around identifying discriminations that are relative to formation of letter components since letter formation is associated closely with legibility (Buros, 1965; Quant, 1946). Some researchers and developers of handwriting curricula recognize the importance of discrimination training and have specified letter formation criteria (Gerard, 1978; Hirsch & Niedermeyer, 1978; Lewis & Lewis, 1965). Stowitschek and Stowitschek (1979) began to explore the issue of teaching discrimination skills and developed an error analysis matrix to help teachers: (a) to identify letter formation attributes and (b) to communicate letter analysis to their students. The letter formation attributes used by Stowitschek and Stowitschek (1979) to assess writing samples drawn from several subject areas are shown in Figure 2. Samples of handwriting are taken from different subject area assignments and analyzed according to each of eleven attributes. Clustering of error types provides the teacher with specific targets for remediation.

FIGURE 2

DLM Handwriting Tally Sheet

Name J. Smith Date 9/10

HANDWRITING PROBLEM	SUBJECT AREAS			TOTAL
	Spelling	English	History	
1. Letters omitted	11	1	111	6
2. Letters added				
3. Letters too large				
4. Letters too small		1		1
5. Bottoms of letters not on line	~~HH~~ 1	111	1111	13
6. Tops of small letters not at midline	11	1	11	5
7. Letters too far apart	1	1		2
8. Letters too close together	1111	1	1111	9
9. Letters too slanted				
10. Letter lines not connected	1		1	2
11. Parts of letters missing				

However, there is more to error analysis than looking for error clusters. At least three approaches to analyzing handwriting errors using the error matrix and models have been discussed in the literature. In Hofmeister's early work (1973), the teacher relies on visual inspection and judges whether there is a match or mismatch between the model and the copied letter. A drawback of this approach is that daily visual inspection procedures were found to require considerable teacher time (Stowitschek & Stowitschek, 1979). In another approach, Cooper and his associates (Cooper et al., 1981) used transparent overlays to facilitate the match-to-sample, match-to-oddity comparisons. With overlays alone, students were able to reliably discriminate between correct letters and letters produced with errors; additionally, teacher involvement was reduced. Trap and his colleagues (1978) found overlays, along with teacher feedback and use of specific consequences improved first graders' letter production.

In a third approach, Stowitschek and Stowitschek (1979) and Stowitschek, Ghezzi and Safely (1987) used correction templates and translucent paper as part of a training procedure in which exceptional students analyzed and corrected their own handwriting errors. As you can see in Figure 3, the student was required to produce a row of letters and then use the template to correct the letters before proceeding to the next row. This self-analysis and correction procedure is efficient in that one does not have to be at the student's side to provide feedback. In addition, the student relearns the letter while the correction procedure is taking place. The procedure is simple to teach because students are able to generalize the use of the templates across practice sets. The procedure involves the use of prepared semitransparent worksheets with model letters at the top and corresponding correction templates. Written instructions are provided to help the teacher

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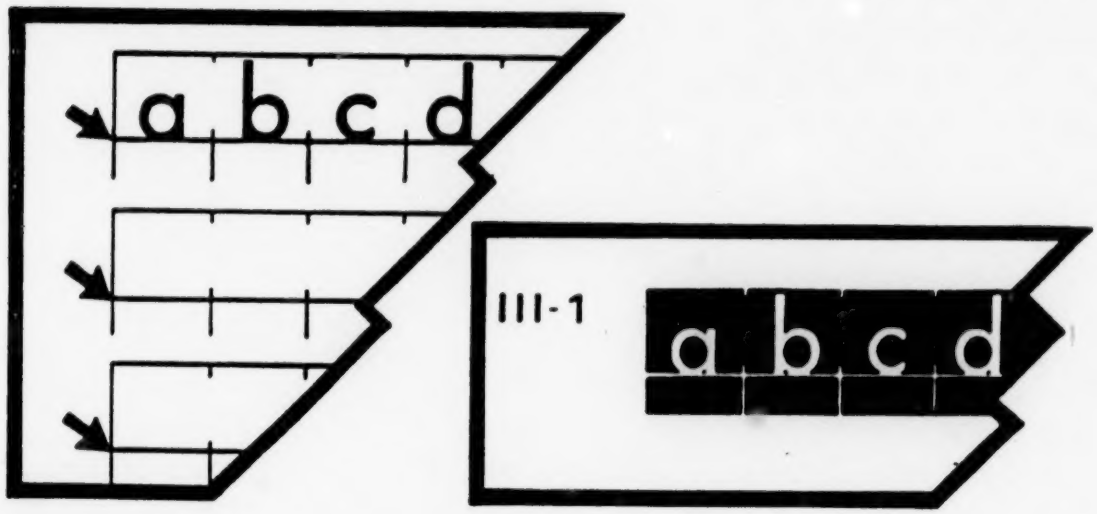
FIGURE 3



train students. There were eight steps/directions in training and they include:

1) complete the first row of the daily worksheet with a pencil;
2) place the template under the worksheet, immediately beneath the row just completed;
3) align the template and maintain alignment using guides printed on the worksheets;
4) highlight missed letters with a transparent felt tip marker;
5) remove the template from underneath the completed row and place it to one side;
6) erase incorrect portions of highlighted letters in which lines fall outside those made by the felt tip marker;
7) correct the highlighted letters with a pencil; and
8) move on to the next row completing only those letters that had to be corrected from the preceding row.

By using this procedure the student corrects each incorrectly written letter, practices only those letters needing correction, and produces a correct model for successive practice rows. The teacher observes and assists the student until the student demonstrates reliable use of the evaluation - correction procedure.

In repeated field tests (Stowitschek & Stowitschek, 1979; Stowitschek, 1978; Stowitschek et al., 1987), exceptional students have rapidly acquired the use of these correction steps and generalized their use to handwriting worksheets for which no training was provided. Although daily handwriting practice was relatively brief (1 1/2 to 3 minutes per worksheet set of nine letters each), student average rate of improvement was 1.66 letters per day

when teacher reinforcement and post-practice monitoring were combined with the self-analysis and correction procedure.

The use of models and carefully structured instructional procedures does not guarantee improved handwriting. As we mentioned, models may be used inappropriately. For instance, teachers who almost exclusively write large model letters on the board or refer to permanent models posted above the blackboard/bulletin board make the assumption that students are able to transfer from blackboard to paper. Although some students are able to perform this feat, many students struggle with the task. Not only must students scale down letter size from the model to their worksheet as they look back and forth from the model to their paper, but they also must interpret other stimulus differences.

Hofmeister (1973) points out another example of inappropriate copying strategies. Many prepared worksheets have model letters printed on the left side of the page. Students are required to copy entire rows of letters from the single model. Teacher feedback usually is delayed at least a day or more. Not only is delayed feedback a problem, but because of the worksheet design students use their own previously produced letters as the model for the next response. A characteristic outcome is that letters become progressively worse as the student uses her own incorrectly produced models. This happens in left to right copying and in instances where model letters are placed at the top of worksheets and students produce columns of copied letters. The problem is that these activities do not have a correction feature or feedback is not provided until the page is finished, turned in, and checked by the teacher.

Other problems in handwriting instruction have to do with overestimating the transferability of letters produced from a model. That is, teachers frequently assume that practice at individual letter production is

transferable to the production of letters in words. For many students, appropriate teacher modeling combined with corrective feedback is necessary to acquire both letter production and word production skills. Another problem occurs when teachers assume that the production of copied letters or words is transferable to conditions in which students use handwriting in the absence of models. Although there is evidence of generalization and transfer from copied letters, the transfer process must be facilitated using intermediate modeling steps, corrective feedback, and appropriate contingencies.

The handwriting instruction problems and principles described above are not indigenous to a particular handwriting style or curriculum sequencing approach. Whether the choice is D'Neilian, or a more traditional approach, the principles are generic.

Integrating Error Correction into Daily Instruction

The analysis of handwriting performance following the completion of initial handwriting instruction is integral to the overall assessment - instruction schemata presented in Figure 1. Teachers must be able to discern when skills mastered in one setting have not transferred to other settings or when handwriting has deteriorated and become nonfunctional. In these instances the teacher must determine the exact source(s) of the problem and design remediation activities accordingly.

As we have noted earlier, formal handwriting instruction and practice occurs during the early years of a student's primary education (grades K-3). After this point, the learner must transfer whatever skills he or she has developed to the contexts of everyday classroom use. Although this generalization is expected of students, there are numerous contextual variables which mitigate against the natural transfer of previously learned skills. Chief among the variable resulting in deficient handwriting are the

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following: (1) It is difficult to concentrate on handwriting when the focus of instruction is on learning and demonstrating skill in another subject matter (e.g., arithmetic computation, history, and language arts); (2) time contingencies are imposed on the completion of subject area assignments; (3) the controlling stimuli during handwriting drill and practice (e.g., copying from a model) are different from the stimuli expected to control handwriting quality in other contexts (e.g., "Answer the questions by filling in the blanks").

In many classroom situations, handwriting is largely ignored and becomes an issue only when the teacher cannot read a student's written work or a student writes so slowly assignments do not get completed. This is the point at which the student may be referred for handwriting remediation. As a result of the referral, the student may be pulled out of the class to "learn" handwriting skills. Remedial practice is provided out of context and the "real" problem may never be addressed. Although remedial practice may be appropriate when initial letter and numeral formation skills are lacking, remediation of illegible handwriting is best accomplished in the setting in which the problem originated. Consider the following case study:

Mr. Watts, a fifth grade reading teacher, and Ms. Greene, a middle school resource teacher, shared a morning break in the teachers' lounge. Today's topic of discussion was Jeremia, an 11-year-old who had been mainstreamed into Mr. Watts' class. When asked how Jeremia was doing, Mr. Watts said, "Well, he seems to be able to handle the content, but I'm sure getting tired of trying to read his handwriting. Can't you do something about it?" Ms. Greene's response was, "He's writes fine when he comes to my room for reading, but I'll look into it." Subsequently, Ms. Greene had Jeremia complete a series of test sheets in which he copied upper and lower case letters of the alphabet and

completed words and numerals in both manuscript and cursive. Although Jeremia could form acceptable letters and numerals, Ms. Greene started him on a program of practice worksheets. Over time, John became a quite accomplished letter and numeral producer. However, Mr. Watts' complaints about Jeremia's legibility remained unchanged.

When a student has demonstrated the ability to adequately form characters and words, but does not write legibly for regular classroom assignments, drill and practice is not an appropriate intervention strategy. The resource teacher, serving as a consulting teacher in the regular classroom, however, can be an effective change agent. "Pullout" instruction on letter and number production typically is not effective because the skill is practiced in isolation from the natural writing context in which there was a problem. One effective approach is to use a diagnostic procedure wherein the teacher and student identify the problem area. Next the targeted behaviors are monitored in relation to the student's classroom performance. This procedure could be accomplished with a student like Jeremia (see example). Ms. Greene, serving as the consulting teacher, might work with Jeremia in the regular classroom in the following way:

Example: After assessing Jeremia's performance in an individual handwriting drill and practice session, Ms. Greene went back to Mr. Watts and asked to see some of Jeremia's science worksheets. Ms. Greene also collected written work samples from his language arts and history teachers. At the next session, Jeremia and Ms. Greene looked through the collected worksheet samples together. Ms. Greene explained that in order to improve his handwriting it would be helpful to determine exactly why Jeremia's handwriting was difficult to read. Here are the steps and the mutual diagnosis and monitoring process which Jeremia and Ms. Greene agreed upon:

1. Identify words or phrases which are hard to read. Jeremia and Ms. Greene went through the worksheets circling all words or phrases which were illegible or nearly illegible. Jeremia circled as many as Ms. Greene circled.

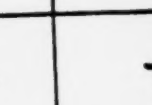
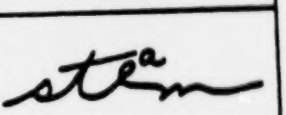
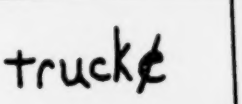
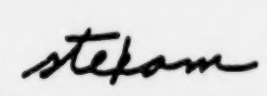
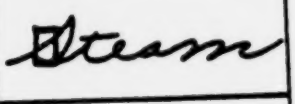
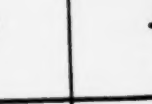
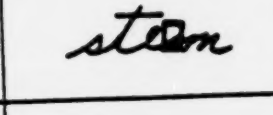
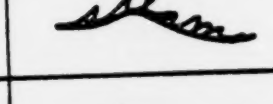
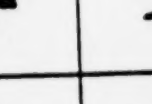
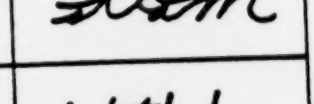
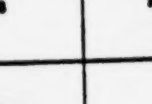
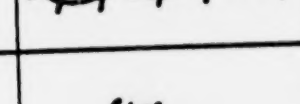
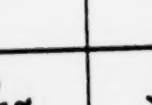
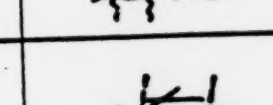
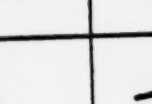
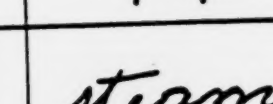
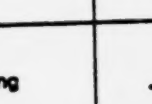
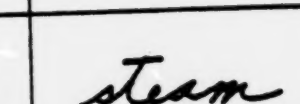
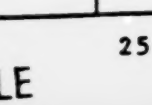
2. Determine what makes the word or phrase difficult to read. After illegible words and passages were identified, Ms. Greene asked Jeremia what he thought was different about each identified word or passage, making it hard to read. "Well, it's kind of up and down," comments Jeremia. Ms. Greene replied, "Do you mean it's not on the line?" Jeremia, "Yeah, that's right." Ms. Greene, "What part of it?" Jeremia, "The middle and end of it on the bottom." Ms. Greene, "So the bottoms of some letters are not on the line. I think we have got one problem figured out."

3. Designate a diagnostic indicator. After Ms. Greene and Jeremia discussed each circled word and phrase and identified the "problem" in them, Ms. Greene said, "Now, let's go back and see if we can figure out the best way to keep track of what we said was different about each word. Look at 'steam' again. Take a colored pencil and redraw the line that the word 'steam' seems to follow so we can compare it to the actual line on the paper." (See Figure 4.) "Now what would you do with those words where the letters are jammed together?" Jeremia, "I'd draw a line between them." Ms. Greene, "You mean like a slash? That's a good idea. Let's do that." Ms. Greene and Jeremia continued this discussion until they determined a mutually agreed upon diagnostic indicator for each problem type. Figure 4 contains a sample of different words identified by Jeremia and Ms. Greene that fall into each of the eleven error categories.

4. Prioritize diagnostic indicators. Ms. Greene prepared a chart, listing the diagnostic points pertaining to Jeremia's handwriting illegibilities. The most common errors contributing to illegibility were at

FIGURE 4

DLM Handwriting Marking Guide

Handwriting Problem	Problem Indicator	Manuscript Example	Cursive Example
1 Letters omitted	write the missing letter above where it should be		
2 Letters added	draw a slash line through the extra letters		
3 Letters too large	draw rectangle on the too large letter		
4 Letters too small	draw a rectangle on the too small letter		
5 Bottoms of letters not on line	with a continuous line, underscore the bases of the letters		
6 Tops of small letters not at midline	draw a line through the mid-point and across tops of lower-case letters		
7 Letters too far apart	draw double slashes between the letters		
8 Letters too close together	draw single wavy line between letters		
9 Letters too slanted	draw a dotted line through the center of the letters that are too slanted		
10 Letter lines not connected	connect the lines		
11 Parts of letters missing	draw in the missing letter part		

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the top of the list. Next to the diagnostic points, she listed the corresponding indicator marks (see Figure 4).

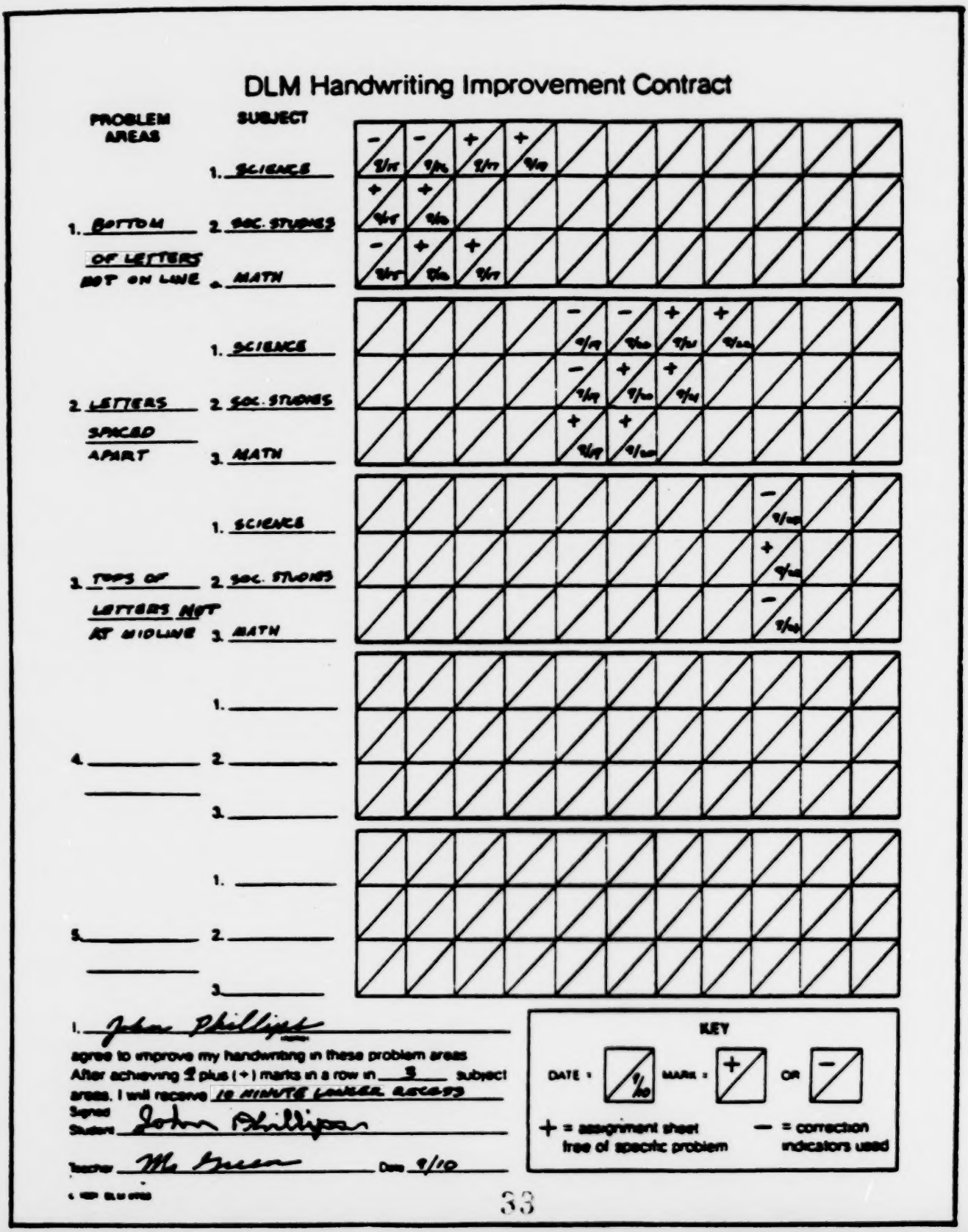
5. Involve teacher confederates. Ms. Greene met with Mr. Watts and explained the mutual diagnosis process. She asked Mr. Watts to use the first diagnostic indicator (a line redrawn with a blue pencil) as he corrected Jeremia's assignments and tests. She arranged to collect the corrected assignments and record the results on her chart before the assignments were returned to Jeremia. Ms. Greene repeated the teacher confederate procedure with Jeremia's language arts and history teachers.

6. Establish contingencies for handwriting improvement. Ms. Greene established a contract with Jeremia as follows: for each assignment returned to Ms. Greene with no redrawn lines, Jeremia would be permitted to take a 10 minute longer recess (arranged with the principal). Figure 5 illustrates the contractual arrangement and record keeping system.

7. Monitor the program. After receiving three successive assignments from each teacher with no re-drawn lines, Ms. Greene asked the teachers to add the next diagnostic check (e.g., a slash between letters that were jammed together). In addition, Ms. Greene began to shift the reinforcing contingencies to the regular teachers' classrooms. For instance, in Mr. Watts classroom Jeremia was given the opportunity to help set up science demonstrations following the successful completion of three successive assignments. This process continued until all teachers were satisfied that Jeremia's handwriting had become legible. Ms. Greene continued to track Jeremia's performance with occasional checks and feedback to Jeremia.

These procedures have been refined into a consulting teacher package and published (Stowischek, Hofmeister & Stowitschek, 1981). This type of assessment - intervention is likely to be successful because the confederate

FIGURE 5


DLM Handwriting Improvement Contract
PROBLEM AREAS
SUBJECT
1. BOTTOM OF LETTERS NOT ON LINE
1. SCIENCE
2. SOC. STUDIES
3. MATH
2. LETTERS SPACED APART
1. SCIENCE
2. SOC. STUDIES
3. MATH
3. TOPS OF LETTERS NOT AT MIDLINE
1. SCIENCE
2. SOC. STUDIES
3. MATH
4. _____
1. _____
2. _____
3. _____
5. _____
1. _____
2. _____
3. _____
1. John Phillips
agree to improve my handwriting in these problem areas
After achieving 2 plus (+) marks in a row in 3 subject areas, I will receive 10 MINUTE LUNCH RECESS
Signed Student John Phillipson
Teacher Mr Green Date 9/10
KEY
DATE = 9/10 MARK = + OR −
+ = assignment sheet free of specific problem
− = correction indicators used

teachers can complete one step at a time. However, it is dependent upon the willingness of teachers to work cooperatively on a common problem with the special education teacher functioning as a consulting teacher. This system is simple, and therefore teachers are likely to be more willing and able to participate. The focus on error reduction narrows the scope of work so that the additional analysis task is manageable for a busy teacher. This error analysis procedure can be tailored to the needs of individual students and is based on samples drawn from every day handwriting assignments. It has a relatively broad range of application and has direct relevance to practical handwriting uses.

Summary

In this chapter we have attempted to relate some appropriate uses of error analysis in handwriting to teachers' expressed areas of concern. We have identified the relationsip of error analysis to handwriting assessment and instruction. The assessment-intervention approach recommended herein may focus on either initial skill development or remediation of handwriting difficulties. Error analysis is not an intervention in and of itself. In fact, there are dangers inherent in focusing exclusively on performance errors when correct performance is the object of instruction. However, error analysis can be a useful tool when identifying and defining the problem. We must remember that although handwriting is an individual expression, it is also a communication tool. If one wishes to communicate (e.g., to gain reinforcers from those with whom we communicate), the recipient of handwritten materials must be able to easily read the communicative attempt. If the reader can easily decipher the written word, the writer will have a much greater chance of procuring reinforcers from the school, community and employment settings.

Questions and Activities

1. Give a brief historical account of prevailing perspectives and approaches to handwriting assessment.

2. Differentiate between the form and function of handwriting skills. Between the qualitative and quantitative dimensions of handwriting.

3. Name five possible positive outcomes for students who become proficient in handwriting.

4. Give a rationale for integrating handwriting error analysis and instruction/remediation.

5. Name steps a special education teacher might take to set up a plan for assessing and remediating handwriting skills in a regular classroom setting.

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